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NUMBER 1

A STUDY ON THE SPREAD OF TUBERCULOSIS  
IN FAMILIES

BY

HERBERT G. LAMPSON



MINNEAPOLIS

Bulletin of the University of Minnesota  
December 1913



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*Biological Sciences*  
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NUMBER 1

## A STUDY ON THE SPREAD OF TUBERCULOSIS IN FAMILIES

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This investigation was carried on under a grant made by the Anti-tuberculosis Committee of the Associated Charities of Minneapolis, Minnesota. The plan of work was determined upon, and the investigation supervised, by a special Committee on Spread of Infection. George Douglas Head, M.D., Associate Professor of Medicine, University of Minnesota, Chairman.



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## A STUDY ON THE SPREAD OF TUBERCULOSIS IN FAMILIES

The special problem to be investigated in this study can be stated as follows:

Given a known case of active tuberculosis in a family, what proportion of the individuals in that family show evidence of an infection with tuberculosis?

The plan of investigation was outlined as follows:

1st. Select a given number of families in each of which a case of pulmonary tuberculosis existed at the time of the investigation and which had been living for at least a year prior to the investigation in the home of each of these families.

2d. Prove the case to be one of tuberculosis by the finding of tubercle bacilli in the sputum or other excreta.

3d. Make a careful scientific study of all the individuals in these families and determine which of them show evidence of tuberculous infection.

4th. Make a similar study in a given number of families in which no persons with tuberculosis had been found, and compare these findings with the findings in the tuberculous families.

Material for the investigation was procured from three sources: (1) cases under the care of the visiting nurses of the Associated Charities of Minneapolis; (2) cases under the care of the Health Department of the City of Minneapolis; and (3) cases under private care.

*Method of procedure and technique.*—When a suitable case for study was found, it was first proved to be tuberculous by the demonstration of the presence of tubercle bacilli in the sputum. This was called the "center case," and so designated in the charts. All the individuals in the house directly exposed were examined and the name, address, date, age, sex, weight, height, nationality, occupation, social condition, general appearance, school attended, nutrition, and exposure (source and time of), were noted on the case card and a record kept.

The examination was made under the following heads: conformation of thorax, glands, bones and joints, skin, throat, lungs, other lesions, sputum, pulse, temperature, and respiration. In addition to the physical examination, tuberculin tests were made in all cases.

The Moro test, consisting of rubbing into the skin over the lower part of the sternum an ointment containing Koch's original tuberculin,

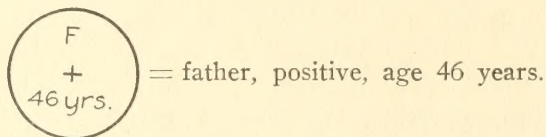
while frequently used, was not used alone, and was not relied on as demonstrating tuberculous infection. The results of the Moro tests have been disregarded in this report.

The Von Pirquet test, which consists of making three scarifications about one inch apart on the skin of the arm and applying to two of them Koch's original tuberculin, leaving the center one as a control, was used in all cases.

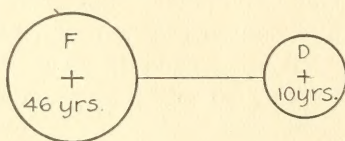
The Subcutaneous test, which consists of injecting subcutaneously Koch's original tuberculin, was used where possible. On account of the character of the material used in the study it was impracticable to use this test in as many cases as was at first planned on account of the difficulty of persuading people to submit themselves to this test.

The cases in which the Moro and Von Pirquet tests were used were all inspected after the lapse of forty-eight hours. A positive reaction to the Moro test is a diffuse redness of the skin with discrete papulation over the area to which the innunction is applied and the time of appearance is from twenty-four to forty-eight hours after its application. A positive reaction to the Von Pirquet test is a conspicuous redness about the points to which the tuberculin is applied, together with slight thickening, and possibly papulation, of the skin in the same area. The extent and brilliance of these reactions vary with the character of the case, but any conspicuous redness with swelling, with or without papulation, is classed as a positive reaction. A positive reaction to the subcutaneous test is the occurrence of a rise in temperature, other causes being eliminated, and a feeling of malaise, headache, backache, etc., during the first or second twenty-four-hour period following the injection.

A positive case of tuberculosis taken as the center case is indicated in the group diagrams by the large heavy circle, with initial, age, and + sign. Thus,



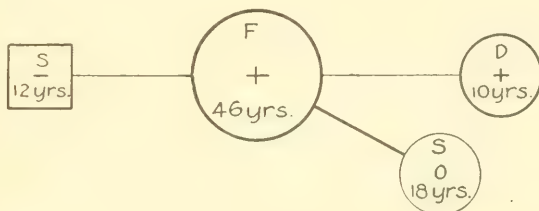
The other positive cases of the group are indicated by smaller heavy circles enclosing relationship initial, + sign, and age, and are connected with the center case circle with a light line. Thus,



The negative cases of the group, or those showing no evidence of infection, are indicated by a square containing the relationship initial, — sign, and age, and connected with the center case circle by a light line. Thus,



The members of the group not seen are indicated by a small lighter circle containing the relationship initial, 0 sign, and age, and are connected to the center case circle by a heavy line. Thus,



The letters used are: H = husband, W = wife, F = father, M = mother, S = son, D = daughter, etc., and indicate the relationship of the individual to the center case.

Some of the group cards have for the center case individuals who were dead at the time of the investigation. These were all undoubted cases of tuberculosis. All others classed as positive center cases were proved open cases by the finding of tubercle bacilli in the sputum.

In addition to the ten non-tuberculous families found during the investigation, all of whom were under observation as tuberculous families or suspects, five other non-tuberculous families were selected and subjected to the same examination and tests as the tuberculous families and were used as controls.

For convenience the groups are reported in alphabetical order rather than in the order in which the work was done. The first thirty-three center cases described are classed as open cases, as in all of them tubercle bacilli were demonstrated in the sputum or the center case was dead of tuberculosis.

Simeon, A., 11th Avenue South. December 18, 1911.

Far-advanced case of pulmonary tuberculosis. Tubercle bacilli present in sputum in great numbers. Was taken sick two years ago with pleurisy



and was told that he had an abscess of the lung. No tubercle bacilli were demonstrated in the sputum at that time. Six months after the onset of disease he left home and lived for nearly a year in Arizona. After three months in Arizona tubercle bacilli were found in his sputum. He returned home nine months ago to die and on his return the first history of a definite exposure can be traced to his family.

Mrs. Ida A., his wife, a large, strong looking woman, with well-formed chest; has no sign of tuberculous infection except a positive Von Pirquet test. On account of her husband's sickness she was not willing to undergo further tuberculin tests.

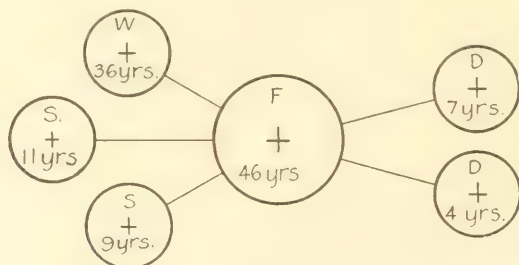
Ellsworth A., son, 11 years, shows several enlarged cervical glands, poor expansion of the chest, pulse 92, temperature 99.8, and gives a positive reaction to the Von Pirquet test.

Harold A., son, 9 years, large and well-developed; shows several enlarged cervical glands, pulse 98, temperature 100, and gives a positive reaction to the Von Pirquet test.

Ruth A., daughter, 7 years, large for her age but with rather poorly formed chest; shows enlarged tonsils, pulse 90, temperature 98.8, with positive reaction to the Von Pirquet test.

Ethel A., daughter, 4 years, of average size, well-nourished, with well-formed chest; shows several enlarged cervical glands, pulse 90, temperature 99.2, and positive reaction to the Von Pirquet test.

Three of the children were away from home for three months and one for five months during the time the father was at home.



In this family are five individuals showing evidence of tuberculous infection.

Peter A., Mill Street. January 13, 1912.

This patient was in the tuberculosis ward at the Minneapolis City Hospital in an advanced stage of pulmonary tuberculosis. He had lived at home nine months after tubercle bacilli had been found in his sputum at the University Free Dispensary.

This house is small, dark, unventilated, but clean.

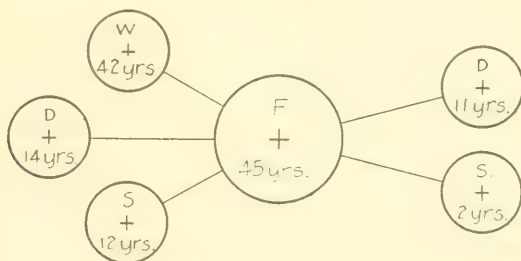
Catherine A., wife, 42 years, a good-sized, robust woman; shows no sign of tuberculous infection except a positive Von Pirquet reaction. A subcutaneous tuberculin test was not permitted in this case.

Anna A., daughter, 14 years, small for her age, well-nourished, with broad, short but stooped chest; shows dullness over right upper and middle lobes posteriorly, fine rales in same area; pulse 96, temperature 99.8, respiration 26, and a positive Von Pirquet reaction. She was sent to the Out-Patient Department of the University Hospital.

John A., stepson, 12 years, large for his age, very well-built and well-nourished; shows three enlarged cervical glands, pulse 84, temperature 100, and a positive Von Pirquet reaction.

Mabel A., daughter, 11 years, small, well-nourished, with well-formed chest; shows two enlarged cervical glands, pulse 84, temperature 99.1, and a positive Von Pirquet reaction.

Jimmy A., son, 2 years, large, well-nourished, well-built; has one enlarged cervical gland, pulse 120, temperature 99; shows a positive Von Pirquet reaction.



There is evidence of tuberculous infection in each member of this family of five.

Isaac A., 4th Street South. December 21, 1910.

A patient in the Thomas Tuberculosis Hospital. He was removed from his home to the hospital within one month from the time tubercle bacilli were found in his sputum. He is 28 years old, tall, slender, fairly well-nourished, with long, narrow, round chest. Shows signs of pulmonary tuberculosis in small areas in both lungs and has tubercle bacilli in his sputum. First examination of family was made three months after tubercle bacilli were found in sputum. Second examination made six months later.

House conditions: family living in two small, unventilated, untidy rooms. Diet fairly nourishing. Husband used sputum cup after diagnosis was made up to the time he left home.

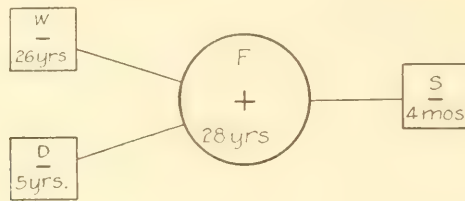
Mary A., wife, 26 years, strong, well-nourished woman; shows no evi-

dence of tuberculous infection; Von Pirquet test negative. Six months later Von Pirquet test again negative.

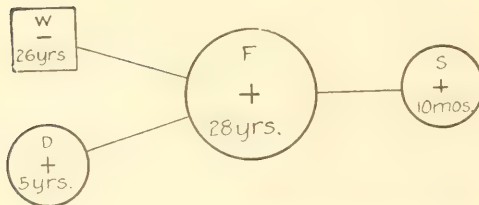
Anna A., daughter, 5 years, of average size, well-nourished; shows no signs of tuberculous infection; negative to Von Pirquet test. Six months later shows positive reaction to Von Pirquet test.

Earl A., son, 4 months, large, very well-nourished baby; shows no signs of tuberculous infection, and is negative to the Von Pirquet test. Six months later gives a positive reaction to the Von Pirquet test.

*First Examination*



*Second Examination*



In this family of four, three showed no evidence of tuberculous infection two months after first known exposure. Six months later two of these three showed evidence of tuberculous infection without further direct exposure.

Mrs. B., 21st Avenue South. December 9, 1911.

House conditions, four small, dark, dirty rooms, no ventilation. The woman died in this house after a sickness of over one year, about one month prior to this examination, of tuberculosis of the lungs.

Father was not examined.

Theresa B., daughter, 17 years, small, well-nourished; shows no signs of tuberculous infection and is negative to the Von Pirquet test.

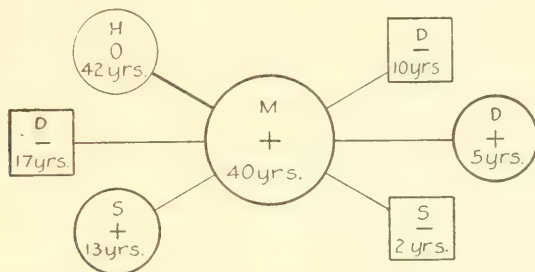
John B., son, 13 years, small, fairly well-nourished; with few enlarged cervical glands and enlarged tonsils; has had recent attack of tonsilitis; no signs of pulmonary tuberculosis, but has signs of active pleuritis with effusion; pulse 90, temperature 99, respiration 26, positive reaction to the Von Pirquet test.



Ruth B., daughter, 10 years, tall, slender, fairly well-nourished, with poorly shaped chest; shows no evidence of tuberculous infection; Von Pirquet test negative.

Josephine B., daughter, 5 years, short, fat, with well-formed chest, four enlarged cervical glands, enlarged tonsils, cogwheel respiration in lower left lobe posteriorly, pulse 90, temperature 99.4; reaction to Von Pirquet test positive.

Harold B., son, 2 years, well-developed and well-nourished; has several enlarged cervical glands; pulse 120, temperature 100.2, respiration 30; Von Pirquet test negative; has had whooping cough for two months.



In this family of five children were two who present evidences of infection with tuberculosis.

Mrs. A., 7th Street South. February 11, 1911.

The center case in this group is a maternal aunt who lived a year in the household and died there at the end of that time of pulmonary tuberculosis. The house was fumigated by the Health Department after her death, but had not been repainted or papered at the time of my last visit. The rooms are dark, unventilated, and overfurnished. The diet is wholesome. No sputum precautions were taken.

One sister and two brothers-in-law were not seen.

Marie, sister, 36 years, shows rales and increased fremitus in right middle lobe and gives a positive reaction to the Von Pirquet test.

Arthur, nephew, 11 years, undersized, poorly nourished; has a poorly shaped chest and enlarged cervical glands; gives a positive reaction to the Von Pirquet test.

Arne, nephew, 9 years, has a poorly shaped chest, enlarged cervical glands and tonsils, and shows distant breathing and pain in right base and altered voice in left base; gives a positive reaction to the Von Pirquet test.

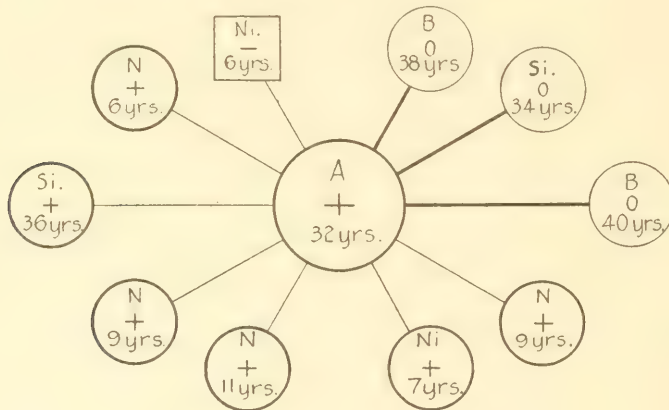
Fred, nephew, 9 years, tall and slender, poorly nourished, with poor general appearance, long narrow chest, and enlarged cervical glands; gives a positive reaction to the Von Pirquet test.

Myrtle, niece, 7 years, of average size, fairly well-nourished; shows rales, dullness, and increased vocal fremitus in left base; has some enlarged cervical glands, pulse 96, temperature 99.4, and gives a positive reaction to the Von Pirquet test.

Ingolf, nephew, 6 years, has had hemorrhages from the lungs and is reported by the City Health Department to have had tubercle bacilli in his sputum, though at the time of this examination he appeared to have little or no physical signs of disease but gives a positive reaction to the Von Pirquet test.

There was another niece, a girl in this family, who was negative to the Von Pirquet test, but the rest of whose record is lost.

Ingolf and Arne lived with their parents next door to the house in which the maternal aunt died. Their father and mother doing day work, these two boys spent most of their time playing with cousins in the house infected by the aunt and are therefore included in this family group.



Of ten people in these two families, seven were examined and six of these showed evidence of infection with tuberculosis.

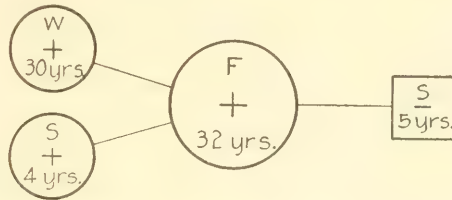
F. J., East 17th Street. January 26, 1911.

This was a far-advanced case of bilateral pulmonary tuberculosis of sixteen months' duration, with large numbers of tubercle bacilli in the sputum. The family was living in a fairly comfortable flat which could not be properly ventilated.

Emma J., wife, 30 years, was not examined, but submitted to the Von Pirquet test, which was positive.

Lloyd J., son, 5 years, of average size, well-developed, and well-nourished; with some slight cervical glandular enlargement; Von Pirquet test negative.

Gerald J., son, 4 years, of average size, well-nourished child; has several enlarged glands, rales in right apex and left base; reaction to the Von Pirquet test positive.



In this family of four members, three show evidence of tuberculous infection.

John C., 24th Avenue North. May 29, 1911.

This man, 22 years old, well-developed, well-nourished; shows fairly advanced pulmonary tuberculosis and has tubercle bacilli in his sputum. His condition was diagnosed in September, 1910, nine months ago, but his history indicates an active trouble as far back as the summer of 1907. He has spent four months in Hopewell Tuberculosis Hospital, leaving there much improved several months ago to go to work.

Caroline C., wife, 23 years, a small, spare, poorly nourished woman, with a long chest and slight cervical glandular enlargements; pulse 64, temperature 99; Von Pirquet test negative.

Luverne C., daughter, 14 months, a strong, well-developed baby, well-nourished; shows slight cervical glandular enlargements and a positive reaction to the Von Pirquet test.



In this family of three, there are two who show evidence of infection with tuberculosis.

Mr. F., Thomas Avenue North. January 10, 1911.

This man was not examined as he was an advanced case of pulmonary tuberculosis in the Thomas Hospital. He had tubercle bacilli in his sputum. He has since died.

House conditions bad; four rooms poorly kept, diet fairly generous, children dirty, and kitchen badly kept. The husband used sputum cup while at home.

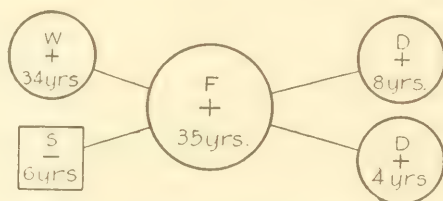


Carrie F., wife, 34 years, well-developed, well-nourished woman; shows no physical signs of tuberculosis, gives a positive reaction to the Von Pirquet test, but is negative to the subcutaneous test.

Ruth F., daughter, 8 years, fairly well-developed and nourished; shows cervical glandular enlargement, gives a positive reaction to the Von Pirquet test.

Clifford F., son, 6 years, fairly well-nourished, undersized, with long constricted chest, many enlarged cervical glands, prolonged expiration in right base; is negative to the Von Pirquet test.

Gladys F., daughter, 4 years, well-developed, well-nourished child; shows no physical signs of tuberculosis, but gives a positive reaction to the Von Pirquet test.



In this family of five, four individuals show evidence of tuberculous infection.

Leonard H., 24th Avenue South. March 7, 1911.

This boy, 22 years of age, was examined shortly before his death from pulmonary tuberculosis in the summer of 1910. Tubercle bacilli were present in his sputum.

Hans H., father, 58 years, very tall and slender, stooped, with a long narrow chest; was examined one year ago, but was not seen at this time. He presents a typical picture of chronic fibroid phthisis and gives a history of cough and occasional hemorrhages for several years. He is now in the State Hospital for the Insane at Rochester.

Martha H., mother, 50 years, strong, heavy woman; is negative physically, and negative to the Von Pirquet test.

Clara H. E., sister, 25 years, tall, slender, poorly nourished, with poorly formed chest; shows crackling rales in left apex, and is negative to the Von Pirquet test. She appeared undoubtedly tuberculous and was referred to the University Free Dispensary, where a few months later the disease was demonstrated by the finding of tubercle bacilli in her sputum.

Amanda H., sister, 22 years, tall and slender, poorly nourished, negative to physical examination; gives a positive reaction to the Von Pirquet test.

Herman H., brother, 19 years, tall, slender, poorly nourished, with poorly shaped chest, poor lung expansion, and evidence of an old pleuritis in right lung; gives a positive reaction to the Von Pirquet test.

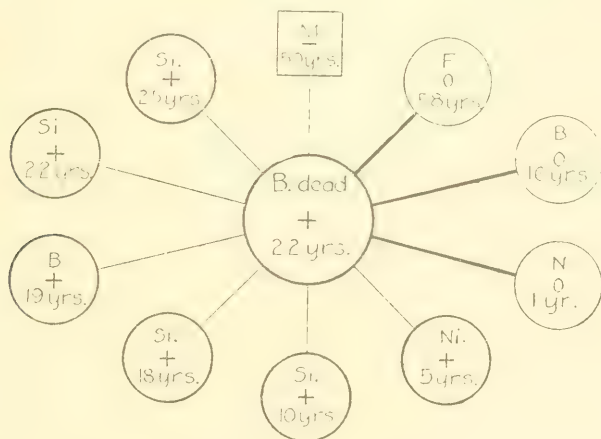
Gertrude H. B., sister, 18 years, strong, well-nourished woman, with well-formed chest; negative to physical examination, and gives a positive reaction to the Von Pirquet test.

Sidney H., brother, 16 years, was not at home. His mother says he is thin and has had a bad cough for a year. He is in the country for his health.

Julia H., sister, 10 years, is small and underdeveloped, poorly nourished, with long, narrow chest; he shows moist and crackling rales over both lungs; no bacilli could be found in her sputum at this time, but tubercle bacilli had been present in sputum; pulse 94, temperature 100.5; Von Pirquet test positive.

Evelyn E., niece, 5 years, a well-developed, well-nourished, healthy looking child; shows no physical signs of tuberculosis, but gives a positive reaction to the Von Pirquet test.

Leonard E., nephew, 1 year, said to be small, underdeveloped baby. He is in the City Hospital for treatment for tubercular hip.



Of this family of originally eleven individuals, seven were examined in this investigation; six of these show evidence of tuberculous infection. One, not examined, is being treated for tuberculosis of the hip. One, previously examined, shows evidence of tuberculous infection, one has a bad cough and is in the country for his health, and one is dead of pulmonary tuberculosis.

Ole H., 44th Avenue North. April 10, 1911.

This man, 49 years of age, has coughed for twenty years. During the last two years many tubercle bacilli have been found in his sputum. The examination shows a diffuse tuberculous process in both lungs. He has gained much under treatment during the last two years.

Inga H., wife, 38 years, good-sized, well-nourished woman, with well-shaped chest; negative to physical examination, and negative to the Von Pirquet test.

Erling H., son, 15 years, well-built boy, well-nourished, negative to physical examination, and negative to the Von Pirquet test.

Harold H., son, 14 years, large, heavy boy, very well-nourished, well-built; is negative to physical examination, and negative to the Von Pirquet test.

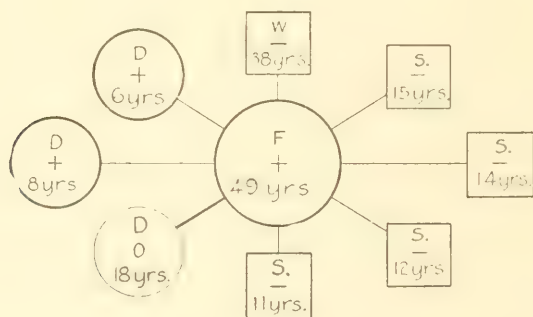
Melvin H., son, 12 years, strong, well-nourished boy; is negative to physical examination, and negative to the Von Pirquet test.

Lyle H., son, 11 years, large, strong, well-built boy, well-nourished, and negative to physical examination; negative to the Von Pirquet test.

Esther H., daughter, 8 years, tall, slender girl, with long, narrow chest; shows slight cervical glandular enlargement and negative to physical examination; gives a positive reaction to the Von Pirquet test.

June H., daughter, 6 years, well-built, heavy girl; shows slight cervical glandular enlargement; temperature 99; negative to physical examination, but shows a positive reaction to the Von Pirquet test.

Another daughter was not seen.



Of eight individuals examined in this family three show evidence of tuberculous infection.

Mrs. H., Snelling Avenue. January 26, 1911.

This woman, 31 years of age, fairly well-nourished, presents signs of active tuberculosis in the left lung. She has been operated on for tuberculous peritonitis. Her sputum contained tubercle bacilli two years ago, but none can be found at the present time. Her first husband died of acute pulmonary tuberculosis. She lived with her present husband and three children in a clean light house of two rooms. Guards her sputum carefully.

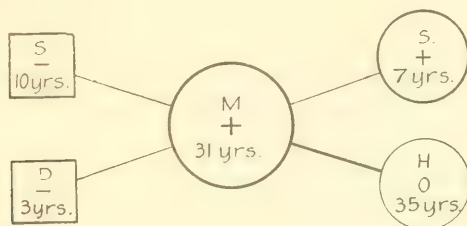
Percy J., son, 10 years, large, well-nourished boy; shows some cervical



glandular enlargement; negative to physical examination, and negative to the Von Pirquet test.

Alfred J., son, 7 years, is a tall, well-nourished boy with slightly constricted chest, considerable cervical glandular enlargement, enlarged tonsils and adenoids; lungs negative; gives positive reaction to the Von Pirquet test.

Helen J., daughter, 3 years, is a plump, well-nourished baby; shows cervical glandular enlargement, and has a slight dry cough; is negative to physical examination, and negative to Von Pirquet test.



In this family of five, of whom four were examined, there are two who show evidence of tuberculous infection.

Mrs. J., 6th Street South. December 1, 1911.

The mother of this family died, a few days prior to my visit, of pulmonary tuberculosis.

The father could not be seen.

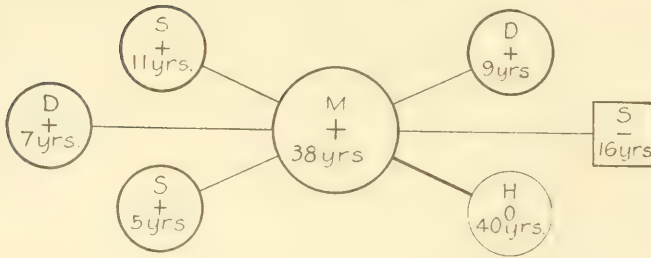
Harry J., son, 16 years, very large and strong, well-built, well-nourished young man; negative to physical examination; temperature 100; is negative to the Von Pirquet test.

Edwin J., son, 11 years, large, well-built, well-nourished boy; shows cervical glandular enlargement, negative chest, positive reaction to the Von Pirquet test.

Alice J., daughter, 9 years, tall, slender girl, fairly well-nourished, with long, narrow chest; negative to physical examination; temperature 100.4, with a positive reaction to the Von Pirquet test.

Edith J., daughter, 7 years, slight, underdeveloped, poorly nourished girl, with long, constricted chest, many rales in base of both lungs; pulse 108, temperature 100.2, respiration 26; positive reaction to the Von Pirquet test.

George J., son, 5 years, strong, well-nourished, well-built boy; with some glandular enlargement; negative to examination; shows a positive reaction to the Von Pirquet test.



In this family are six individuals, of whom five were examined. Three of these five show evidence of tuberculous infection.

Mr. J., 18th Avenue North. December 27, 1910.

Wife, age 47, large, strong, well-nourished, with well-shaped chest; shows crepitant rales in apex of left lung: Von Pirquet test negative. She lives with her children in four basement rooms where her husband lay sick for some months with pulmonary tuberculosis before dying in the City Hospital. The six people all sleep in one room twelve feet square.

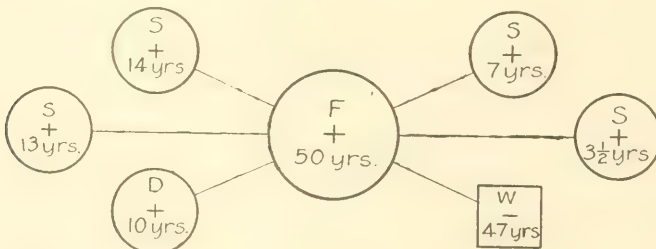
John J., son, 14 years, fairly well-nourished and developed; shows slight cervical glandular enlargement, rales and high pitched resonance in right base posteriorly; positive reaction to the Von Pirquet test.

Joseph J., son, 13 years, well-developed, well-nourished boy; negative to physical examination; pulse 100; shows positive reaction to the Von Pirquet test.

Bessie J., daughter, 10 years, well-developed, well-nourished girl; shows cervical glandular enlargement; gives positive reaction to the Von Pirquet test.

Melvin J., son, 7 years, fairly well-developed and nourished, with poorly formed chest, and cervical glandular enlargement; negative to physical examination; temperature 99.8; gives a positive reaction to the Von Pirquet test.

Iner J., son, 3½ years, a well-developed, well-nourished boy, with a poorly formed chest and enlarged cervical glands; negative to physical examination; shows a positive reaction to the Von Pirquet test.



Each member of this family of six shows evidence of tuberculous infection, except the mother.

C. M. J., Washington, Avenue North. May 26, 1911.

This man died about three weeks prior to my visit in the tuberculosis ward of the Minneapolis City Hospital, where he had been for three weeks. For six months before that he had lived at home sick with pulmonary tuberculosis in a house of five, fairly large, well-ventilated, but dark rooms, with his wife and six children.

Mary J., wife, 36 years, small, poorly developed woman, with deformed spine and chest; her lungs show signs of healed tuberculous lesions; temperature 99.8; Von Pirquet test negative.

Alice J., daughter, 17 years, robust, well-nourished girl, well-developed, negative to physical examination, with poor expansion, pulse 100, temperature 99.5; shows positive reaction to the Von Pirquet test.

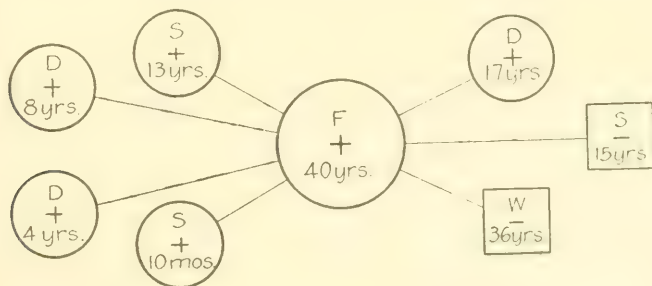
John J., son, 15 years, large, well-developed boy, fairly well-nourished, with slight cervical glandular enlargement, negative to examination, and gives negative reaction to the Von Pirquet test.

Charles J., son, 13 years, small but well-formed and well-nourished, negative to examination; temperature 99.5; shows positive reaction to the Von Pirquet test.

Elizabeth J., daughter, 8 years, small, poorly developed, poorly nourished child, with long narrow chest, slight cervical glandular enlargement, temperature 99.2; gives a positive reaction to the Von Pirquet test.

Evelyn J., daughter, 4 years, well-developed, well-nourished child, with slight cervical glandular enlargement, fine rales over right upper lobe anteriorly, pulse 94, temperature 100.2; shows a positive reaction to the Von Pirquet test.

Harry J., son, 10 months old, large fat baby, well-formed, negative to examination; shows positive reaction to the Von Pirquet test.



In this family of seven individuals, there are five showing evidence of tuberculous infection.



Fred K., Aldrich Avenue North. March 30, 1912.

This boy, 23 years old, underweight, poorly nourished, shows signs of moderately advanced pulmonary tuberculosis, with tubercle bacilli in his sputum.

The parents were not examined.

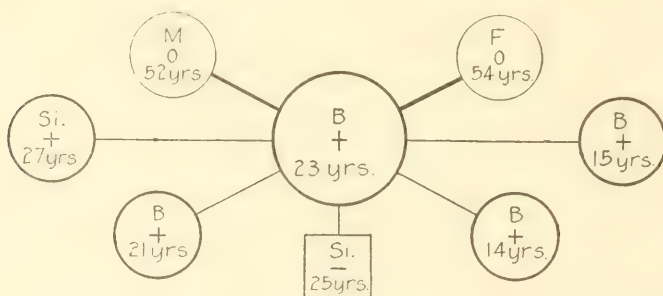
Eleanor K., sister, 27 years, slightly built, fairly well-nourished, with poorly formed chest and poor expansion; negative to examination; temperature 99; gives a positive reaction to the Von Pirquet test. This girl is said to have had pulmonary tuberculosis when a child.

Bertha K., sister, 25 years, fairly well-nourished, with poorly formed chest and fine rales in left apex posteriorly; temperature 99.2; negative to the Von Pirquet test.

Carl K., brother, 21 years, well-developed, strong, well-nourished young man, with very well-formed chest; negative to physical examination; gives a positive reaction to the Von Pirquet test.

Albert K., brother, 15 years, a well-developed, well-nourished boy; has slight cervical glandular enlargement; negative to examination; shows positive reaction to the Von Pirquet test.

Arthur K., brother, 14 years, undersized, well-nourished, well-built; shows cervical glandular enlargement; negative to examination; temperature 99; gives a positive reaction to the Von Pirquet test.



Of the six children, five show evidence of tuberculous infection.

Ben K., 23d Avenue South. April 13, 1911.

This boy, age 16, is an advanced case of pulmonary tuberculosis with many tubercle bacilli in his sputum. Has died of tuberculosis since he was seen.

Peter K., father, 52 years, heavy built man, with well-formed chest; negative to examination; temperature 99.2; gives a positive reaction to the Von Pirquet test.

Carrie K., mother, 47 years, good-sized, well-nourished woman, with long chest, slight axillary glandular enlargement, chronic skin eruption on

right forearm which she has had for eleven years; shows signs of old pleurisy on the right side; had pneumonia on the same side 24 years ago; temperature 99.4; and gives a positive reaction to the Von Pirquet test.

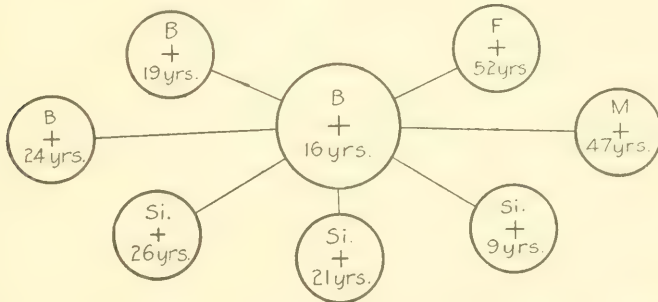
Anna K. B., sister, 26 years, advanced case of pulmonary tuberculosis with tubercle bacilli in the sputum.

Louis K., brother, 24 years, advanced case of pulmonary tuberculosis with tubercle bacilli in the sputum. Has since died.

Julia K., sister, 21 years, small, fairly well-nourished girl, with well-formed chest, slight cervical enlargement, distant breathing and egophony over left scapula; temperature 100; gives a positive reaction to the Von Pirquet test.

James K., brother, 19 years, of medium size, fairly well-nourished, with round long chest, slight cervical enlargement; negative to physical examination; temperature 99; gives a positive reaction to the Von Pirquet test.

Byrdie K., sister, 9 years, fairly well-developed, well-nourished child; is now suffering from chorea; has a long but fairly well-shaped chest, considerable cervical glandular enlargement; is negative to examination; pulse 94, temperature 99.8; has recently had tonsilitis; gives a positive reaction to the Von Pirquet test.



In this family of eight, every individual shows evidence of tuberculous infection.

Mrs. K., Seymour Avenue Southeast. June 29, 1911.

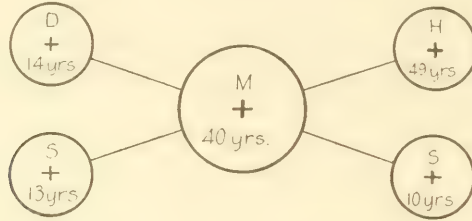
This woman, 40 years of age, is an advanced case of pulmonary tuberculosis with many tubercle bacilli in her sputum.

Charles K., husband, 49 years, a tall, spare man, fairly well-nourished, negative to examination; shows a positive reaction to the Von Pirquet test; gives a history of pleurisy ten years ago.

Marian K., daughter, 14 years, large, well-developed, well-nourished girl, negative to examination; pulse 86, temperature 99.4; shows positive reaction to the Von Pirquet test.

Harold K., son, 13 years, well-developed, well-nourished boy, with well-shaped chest; negative to examination; temperature 99.2; shows a positive reaction to the Von Pirquet test.

Horace K., son, 10 years, underdeveloped, fairly well-nourished, with poorly shaped chest and poor expansion; negative to examination; pulse 100, temperature 101; gives positive reaction to Von Pirquet test.



In this family of five, every individual shows evidence of tuberculous infection.

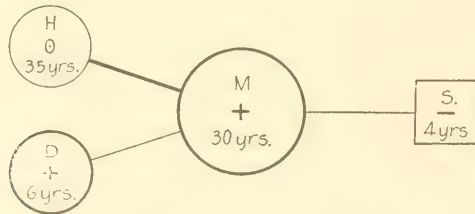
#### Mrs. L.

This woman has an active tuberculous lesion in the left apex and tubercle bacilli in her sputum. She nursed her brother, who died of tuberculosis six years ago.

Her husband was not seen.

M. L., daughter, 6 years, a well-developed, well-nourished child, negative physically; gives a positive reaction to the Von Pirquet test.

P. L., son, 4 years, a well-developed, well-nourished boy; shows slight cervical glandular enlargement; negative physically and negative to the Von Pirquet test.



This woman and her husband are exceptionally intelligent people and are highly educated. They have an ideal home. They have been fully aware of the danger of infection from tuberculosis and fully aware of the woman's condition. The husband was not examined. Of these three individuals, two show evidence of tuberculous infection.



Ella L., 5th Street Northeast. September 3, 1911.

This woman died of pulmonary tuberculosis four months prior to my visit in the house where the family now lives. Minneapolis Health Department records show the presence of tubercle bacilli in her sputum.

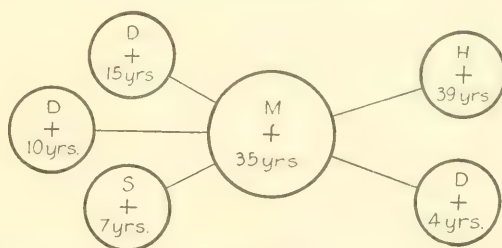
Andrew L., husband, 39 years, strong, well-nourished man; has a poorly shaped chest and signs of healed tuberculous lesion in left apex; temperature 99.1; shows a positive reaction to the Von Pirquet test.

Anna L., daughter, 15 years, well-developed, well-nourished girl, with slight cervical glandular enlargement, negative to physical examination, anemic; temperature 99.5; gives a positive reaction to the Von Pirquet test.

Mary L., daughter, 10 years, well-developed, well-nourished girl, with poorly shaped chest, slight cervical glandular enlargement and cogwheel respiration in right upper lobe; pulse 84, temperature 99.6; shows a positive reaction to the Von Pirquet test.

John L., son, 7 years, well-developed, fairly well-nourished, with poorly shaped chest and slight cervical glandular enlargement; pulse 92, temperature 99.2; negative physically, but shows a positive reaction to the Von Pirquet test.

Elizabeth L., daughter, 4 years, well-developed, well-nourished child, with slight cervical glandular enlargement; pulse 116, temperature 99; shows a positive reaction to the Von Pirquet test.



In this family of five, every individual showed evidence of tuberculous infection.

Sylvester M., 12th Avenue North. December 10, 1910.

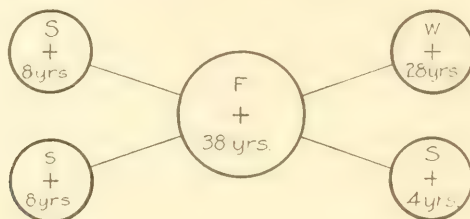
This man, 38 years, is in a very advanced stage of pulmonary tuberculosis, with many tubercle bacilli in his sputum. He has been cared for away from home much of the time during the last seven months. The rest of the time he has been at home with his wife and three children. The house conditions are poor. He has been careless about his sputum, though he well understands the risk to his family. He has since died.

Christina M., wife, 28 years, strong looking, spare woman, with a well-shaped chest and some fine rales in the right apex; Von Pirquet test negative. Tested again four months later, Von Pirquet test positive.

LeRoy M., son, 8 years, small, underdeveloped, poorly nourished boy, with poorly shaped chest and some cervical glandular enlargement; negative to physical examination; temperature 99.6; negative to the Von Pirquet test. Four months later positive to the Von Pirquet test.

George M., son, 8 years, small, poorly nourished; shows cervical glandular enlargement; negative to physical examination; temperature 100.4; Moro test positive, Von Pirquet test negative. Four months later Von Pirquet test positive.

Elmer M., son, 4 years, well-developed, well-nourished boy, showing some cervical glandular enlargement; negative physically; temperature 99.8, Moro reaction positive. Four months later Von Pirquet test positive.



In this family of five, every individual showed evidence of tuberculous infection.

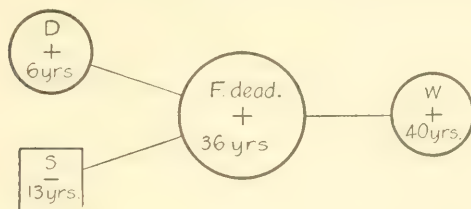
Hulda O., Cedar Avenue. May 11, 1911.

This woman, age 40, is tall and slight, has a long narrow chest, and shows signs of infiltration in middle lobe of right lung. Her husband died four years ago after an illness of two years of pulmonary tuberculosis with many tubercle bacilli in his sputum.

She lives in a small dark flat and does family sewing and rents one room to lodgers. This has been classed as an active case on account of the exposure of the whole family during the father's sickness, he being taken as the center case.

Melvin O., son, 13 years, large, strong, well-nourished boy, with poorly shaped chest; has an acute bronchitis; temperature 99; Von Pirquet test negative.

Helen O., daughter, 6 years, slender, active, fairly well-nourished girl, with well-shaped chest and slight cervical glandular enlargement; negative to physical examination; temperature 98.8; gives a positive reaction to the Von Pirquet test.



Of the three surviving members of this family, two show evidence of tuberculous infection.

Mrs. O., Pleasant Street Southeast. June 20, 1911.

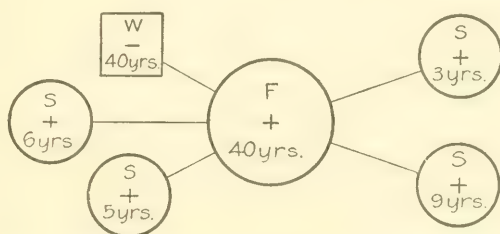
This woman's husband died of pulmonary tuberculosis about two years ago after an illness of several years. He had many tubercle bacilli in his sputum. The woman was not examined as she is a private case. She gives a negative Von Pirquet test.

Gustav O., son, 9 years, undersized, fairly well-nourished, with poorly shaped chest and general glandular enlargement; negative to physical examination; temperature 99; gives a positive reaction to the Von Pirquet test.

Carl O., son, 6 years, well-developed, well-nourished boy, shows some cervical glandular enlargement; negative physically; temperature 99.2; gives a positive reaction to the Von Pirquet test.

Ebbe O., son, 5 years, large, well-developed, well-nourished boy, showing slight cervical glandular enlargement; negative to physical examination; gives a positive reaction to the Von Pirquet test.

Swen O., son, 3 years, stout, well-nourished boy, showing some cervical glandular enlargement; negative to physical examination; temperature 99.2; gives a positive reaction to the Von Pirquet test.



In this family of five individuals, four show evidence of infection with tuberculosis.

Frank N., Main Street Northeast. July 16, 1911.

This man is well-built, fairly well-nourished, with a well-shaped chest. Both lungs show signs of active tuberculosis and the sputum contains tu-

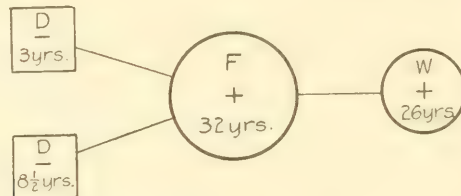
bercle bacilli. He gives a history of pleurisy twelve years ago with slow recovery. Six months ago he took a severe cold and one month later had a pulmonary hemorrhage. He went to the City Hospital at that time and stayed there until six weeks ago. He then went to work and has worked since.

The wife says that her husband is careless with his sputum. He has been away from home nearly all of his infective period.

Julia N., wife, 26 years, a large, strong, well-nourished woman, negative to examination; gives a positive reaction to the Von Pirquet test.

Anna N., daughter, 8½ years, a large, well-nourished child, showing slight cervical glandular enlargement; temperature 99.4; negative to the Von Pirquet test.

Alice N., daughter, 3 years, a stout, heavy child, showing slight cervical glandular enlargement, negative to examination, and negative to the Von Pirquet test.



In this family of four individuals, two show evidence of tuberculous infection.

Mrs. N., 24th Avenue South. September 1, 1911.

Mary N., mother, 30 years, tall, thin woman, with a long stooped chest, shows signs of healed tuberculous lesions in right upper and middle lobes. Gives a positive reaction to the Von Pirquet test.

Alma N., daughter, 12 years, large, well-nourished girl with a well-formed chest; shows slight cervical glandular enlargement; negative to physical examination; gives a positive reaction to the Von Pirquet test.

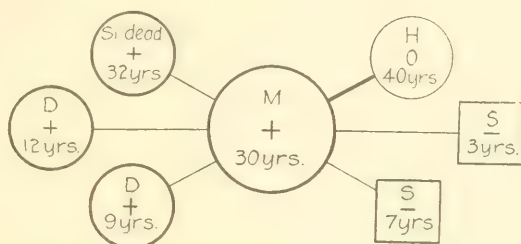
Dora N., daughter, 9 years, well-developed, well-nourished girl; shows slight cervical glandular enlargement; negative to physical examination; shows a positive reaction to the Von Pirquet test.

John N., son, 7 years, large, well-nourished boy, with slight cervical glandular enlargement. He is very deficient mentally as a result of an acute meningitis and it was impossible to examine him. The Moro test was negative.

James N., son, 3 years, sturdy, well-nourished boy, with slight cervical glandular enlargement; negative physically; negative to the Von Pirquet test.



A sister of the mother of this family recently died of tuberculous peritonitis in this house. The mother, who shows signs of a healed pulmonary tuberculosis, gives a history of cough, loss of weight, and pulmonary hemorrhages prior to seven years ago at which time her health improved. The children over seven years of age show evidence of tuberculous infection and those under that age do not.



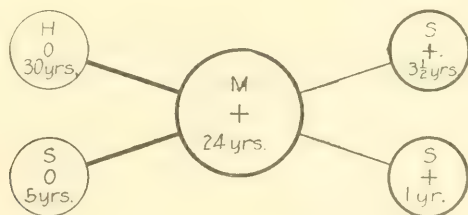
In this group of five individuals, three show evidence of tuberculous infection.

Mrs. Ida R., Oakland Avenue. March 1, 1911.

This woman, age 24, slight, fairly well-nourished, with well-shaped chest, is an advanced open case of pulmonary tuberculosis. There are many tubercle bacilli in her sputum. She has been with these two children and has had all the care of them much of the time since she became sick. An older child has been away from home most of the time and was not examined. The husband could not be examined. The house conditions are bad, diet poor and poorly prepared. Sputum is guarded.

Roy R., son, 3½ years, well-developed, well-nourished child; has a well-formed chest; negative to physical examination; pulse 108, temperature 99.8; shows a positive reaction to the Von Pirquet test.

Warren R., son, 1 year, small, fairly well-nourished; negative to physical examination; pulse 120, temperature 100; gives a positive reaction to the Von Pirquet test.



In this family of five only three could be examined, all of whom showed evidence of tuberculous infection.

Joseph R., Snelling Avenue. December 29, 1911.

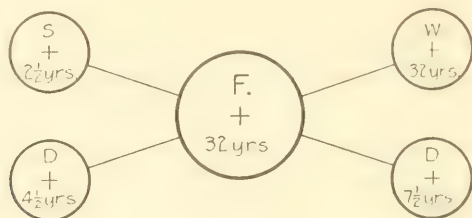
This man, 32 years, tall, well-developed, well-nourished, is an active open case of pulmonary tuberculosis with many tubercle bacilli in his sputum.

Mary R., his wife, 32 years, is a large, strong appearing woman with a flat chest; has poor expansion; is negative to examination; pulse 94, temperature 100; gives a positive reaction to the Von Pirquet test.

Mary R., daughter, 7½ years, small, well-nourished girl with a well-formed chest; shows slight cervical glandular enlargement; negative to physical examination; temperature 99; gives a positive reaction to the Von Pirquet test.

Flossie R., daughter, 4½ years, small, fairly well-nourished; shows many enlarged cervical glands; negative to physical examination; gives a positive reaction to the Von Pirquet test.

Jerry R., son, 2½ years, heavy, well-nourished baby, with a broad, flat chest, many enlarged cervical glands; negative to physical examination; gives a positive reaction to the Von Pirquet test.



In this family of five, each individual shows evidence of tuberculous infection.

Mrs. P. S., 24th Avenue North. January 24, 1911.

This woman, age 27, who is a moderately advanced case of pulmonary tuberculosis with tubercle bacilli in her sputum, gives a rather remarkable history of exposure. She could at first give no history of exposure as there had never to her knowledge been a case of tuberculosis in her family or among her intimate associates. On further inquiry the following facts were developed. In the spring of 1909 she entertained a guest for a period of three weeks. This man was sick and coughed badly, raised much sputum, discharging the sputum in his handkerchief and drying the handkerchief, when saturated, over or under the kitchen stove. After three weeks they discovered that he was tuberculous and asked him to leave. Six or eight months later in the winter of 1909 and 1910 the family moved into a new house which had never been occupied. Three months later, in the spring of 1910, Mrs. S. developed pleurisy. During the summer of 1910 Mr. S. developed pleurisy. In the fall of 1910 one of the children began to fail and

developed fever. At the present time, namely three months later, the following conditions are present:

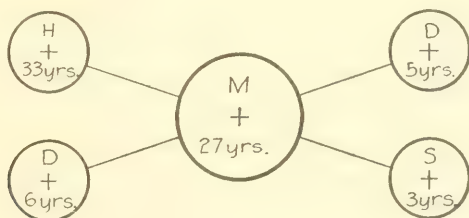
Mrs. S., 27 years, well-developed, poorly nourished woman; a moderately advanced open case of pulmonary tuberculosis with many bacilli in her sputum.

Peter S., her husband, 33 years, large, strong, well-nourished man, with poorly shaped chest; has slight curvature of the spine, shows rather vague signs on physical examination; pulse 90; gives a positive reaction to the Von Pirquet test, and a positive reaction to the subcutaneous test.

Beatrice S., daughter, 6 years, well-developed, well-nourished child; shows some cervical glandular enlargement; negative to physical examination and shows a positive reaction to the Von Pirquet test.

Pearl S., daughter, 5 years, a large, very well-developed, well-nourished child, shows enlarged cervical glands; negative to physical examination and gives a positive reaction to the Von Pirquet test.

Earling S., son, 3 years, good-sized, well-nourished child with a well-shaped chest; shows some cervical enlargement; negative to physical examination; temperature 100, with a positive reaction to the Von Pirquet test.



Each member of this family of five persons shows evidence of tuberculous infection.

George S., 19th Avenue Northeast. July 9, 1912.

The mother of this family died of pulmonary and laryngeal tuberculosis a few days prior to my visit. She had many tubercle bacilli in her sputum. This large family of eight children have been poorly clothed and poorly fed and poorly cared for in every way. They are a hardy lot as a whole and practically live out of doors.

George S., father, 45 years, large, well-built man, negative to physical examination, and negative to the Von Pirquet test.

Joseph S., son, 13 years, tall, poorly nourished, with a long narrow chest, some cervical glandular enlargement, crepitant rales and dullness in right lung; temperature 99.2; gives positive reaction to the Von Pirquet test.

Helen S., daughter, 11 years, tall, fairly well-nourished girl, with a

broad chest, slight cervical glandular enlargement, rales and dullness in both lungs; pulse 98, temperature 99; gives a positive reaction to the Von Pirquet test.

Margaret S., daughter, 9 years, well-developed, well-nourished girl; shows some cervical glandular enlargement and some cogwheel respiration in left lung; pulse 104, temperature 99.4; gives a positive reaction to the Von Pirquet test.

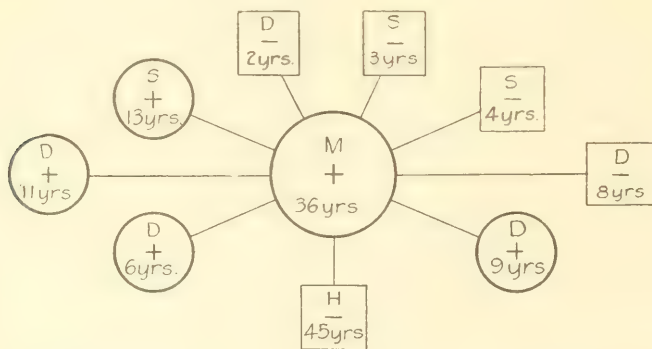
Anna S., daughter, 8 years, well-built, well-nourished child; shows many enlarged cervical glands; negative to physical examination; pulse 100, temperature 99.8; negative to Von Pirquet test.

Elsie S., daughter, 6 years, small, poorly developed, poorly nourished child, with many enlarged glands; negative to physical examination; gives positive reaction to the Von Pirquet test.

Lawrence S., son, 4 years, well-developed, well-nourished boy, showing many enlarged cervical glands, poorly shaped chest; physical examination negative; pulse 104; gives negative reaction to the Von Pirquet test. This boy is an imbecile.

George S., Jr., son, 3 years, well-formed, well-nourished boy, negative to physical examination; pulse 108, temperature 99; Von Pirquet test negative.

Theresa S., daughter, 2 years, heavy, well-developed baby, negative on physical examination, negative to the Von Pirquet test.



In this family of nine individuals, four show evidence of tuberculous infection.

Carrie S., 16th Avenue South. November 20, 1911.

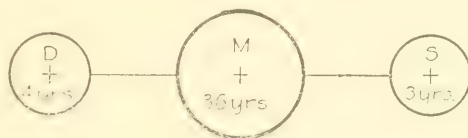
This woman, 36 years, is in an advanced stage of pulmonary tuberculosis with many tubercle bacilli in her sputum.

Florence S., daughter, 4 years, heavy, well-developed child; shows enlarged cervical glands; negative to physical examination; temperature 99; positive to the Von Pirquet test.



Howard S., son, 3 years, heavy, well-developed baby; has many enlarged cervical glands, one of which is broken down, is negative to physical examination, but shows positive reaction to the Von Pirquet test.

This woman's mother died of tuberculosis twenty-three years ago; her father from the same cause six years later. She nursed them both. One sister died of tuberculosis fourteen years ago, another five years ago. One other sister is dead, but the cause of death is not known. She has three brothers, one of whom, she says, has weak lungs.



This family of three individuals shows evidence of tuberculous infection in all the members.

Sophie S., 29th Avenue South. February 9, 1911.

This woman, 36 years, well-built, well-nourished, has moderately advanced pulmonary tuberculosis with tubercle bacilli in her sputum. She with her husband and baby live in a one-room house with a seven-foot ceiling. Her husband's mother and sister died of tuberculosis and another sister is in Hopewell Tuberculosis Hospital. She was closely associated with all these people.

Mr. S., husband, could not be examined.

Pearl S., daughter, 2 years, very fat heavy baby, has tuberculous lesions on her right thumb and on two toes on her left foot. Her lungs are negative to examination; she gives a positive reaction to the Von Pirquet test.



In this family the two who were examined show evidence of tuberculous infection.

Theodore Z., Colfax Avenue North. January 27, 1912.

This man, 44 years, is a moderately advanced open case of pulmonary tuberculosis. His sputum has contained tubercle bacilli for many months. The father of this family is known to have had tubercle bacilli in his sputum for at least one year. He is a well-trained patient and has carefully isolated himself from his family.

Amelia Z., wife, 40 years, is a small, well-nourished woman, with well-developed chest; shows a small area of consolidation in right lung; temperature 99.2, Von Pirquet test negative; the subcutaneous tuberculin test, used on account of lung signs, was also negative. Three months later the visiting nurse reports that she had a pulmonary hemorrhage.

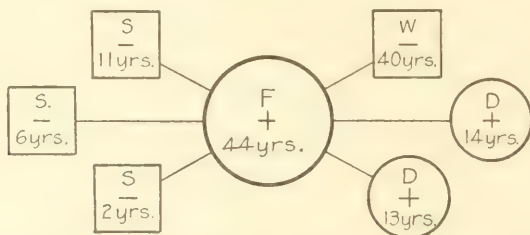
Mathilda Z., daughter, 14 years, underdeveloped, poorly nourished girl, with a long narrow chest, cervical glandular enlargement, poor expansion, rales and dullness in right upper lobe. Sputum is negative, pulse 116, temperature 98, Von Pirquet test positive, subcutaneous test positive.

Amelia Z., daughter, 13 years, well-developed, very well-nourished girl, with well-shaped chest; is negative to physical examination, gives a positive reaction to the Von Pirquet test, and a positive reaction to the subcutaneous test. Five milligrams of old tuberculin were used in the subcutaneous test.

Theodore Z., son, 11 years, small, poorly nourished boy with a long narrow chest, much cervical glandular enlargement; negative to physical examination; negative to the Von Pirquet test.

Fred Z., son, 6 years, small, poorly nourished boy, with a long stooped chest; negative to physical examination; temperature 99.3; gives a negative reaction to the Von Pirquet test.

Al. Z., son, 2 years, well-developed, well-nourished baby; negative to physical examination and negative to the Von Pirquet test.



In this family of seven individuals, three show evidence of tuberculous infection.

The center cases of the four following groups are classed as latent as they show clinical signs of pulmonary tuberculosis and are reported as having had tubercle bacilli in the sputum, though none could be found at the time of my investigation.

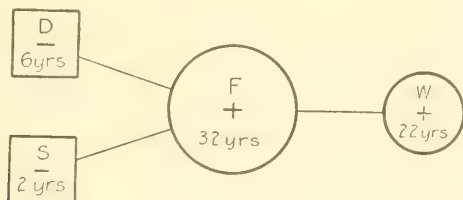
John C., 44th Avenue South. June 13, 1911.

This man, 32 years old, is large and powerfully built; there are a few rales and slight dullness in the upper lobe of the left lung; no tubercle bacilli have ever been found in his sputum; gives a positive reaction to the Von Pirquet test.

Henrietta C., wife, 22 years, is a strong, well-nourished woman who presents no physical signs of tuberculosis except a positive reaction to the Von Pirquet test. She was very definitely exposed to tuberculosis eleven years ago when two sisters died of the disease.

Henrietta C., daughter, 6 years, is a well-nourished, well-developed child with slight cervical glandular enlargement; negative to physical examination and negative to the Von Pirquet test.

John C., Jr., son, 2 years, large, well-nourished child, shows a slight cervical glandular enlargement; negative to physical examination and negative to the Von Pirquet test.



In this family of four individuals, two show evidence of tuberculous infection. Both parents are infected, possibly from different sources. Neither of the children shows signs of infection. Neither parent has shown tubercle bacilli in the sputum.

Carl C., 12th Street South. September 26, 1911.

This man, 30 years of age, strong appearing and well-nourished, with barrel-shaped chest, was diagnosed tuberculous three years ago and tubercle bacilli were found in his sputum at that time. At present he appears to be an arrested or healed case. Shows limited lung expansion, and a positive reaction to the Von Pirquet test. On account of the unfortunate circumstance of this man's losing his position through the fact becoming known that he was suspected of being tuberculous he presented himself to one of our specialists for further examination. The subcutaneous tuberculin test was applied and he gave a positive reaction, showing that somewhere he still has a focus of tuberculous infection.

Mary C., wife, 29 years, small, poorly nourished woman, presents no signs of tuberculosis and is negative to the Von Pirquet test.

Carl C., son, 8 years, small underdeveloped child, fairly well-nourished, with a well-shaped chest, shows slight cervical glandular enlargement; temperature 99.5; negative to the Von Pirquet test.

Joseph C., son, 6 years, fairly well-developed, well-nourished boy, with chest constricted at the base on the left side, slight cervical glandular enlargement, and definite signs of tuberculous infection in the left lung; pulse 86, temperature 99.5; and positive reaction to the Von Pirquet test. Was

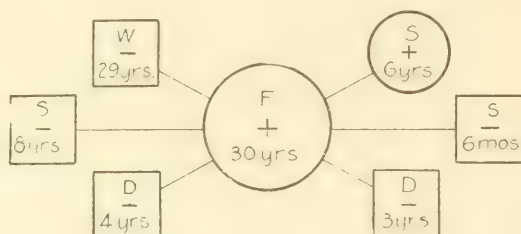
diagnosed tuberculous one year ago, has spent this summer in the visiting nurses' tuberculosis camp and is much improved.

Mary C., daughter, 4 years, of average size, well-nourished and well-developed, is negative to physical examination and negative to the Von Pirquet test.

Aggie C., daughter, 3 years, large, well-nourished, well-developed child, with slight cervical glandular enlargement; is negative to physical examination and negative to the Von Pirquet test.

Anthony C., son, 6 months, is suffering from extreme malnutrition but was negative to the Moro test which was the only one that could be used in this case.

These children have but scant care, although their home conditions are not very bad.



In this family of seven individuals, only two show evidence of tuberculous infection.

Anna O., Knox Avenue North. January 17, 1911.

Anna O., 15 years, good-sized, well-nourished girl; shows very slight signs in the left lung. No tubercle bacilli were found in her sputum. The Von Pirquet test was not made, but she reacted positively to the subcutaneous test.

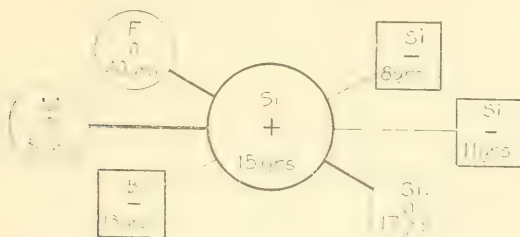
Arnold O., brother, 13 years, large, very well-nourished boy, shows slight cervical glandular enlargement; negative to examination, negative to the Von Pirquet test.

Hilda O., sister, 11 years, well-developed, well-nourished girl; negative to examination, negative to the Von Pirquet test.

Ruth O., sister, 8 years, well-developed and well-nourished girl, with some cervical glandular enlargement; negative to examination and negative to the Von Pirquet test.

The father, mother, and one sister were not examined.





In this family of seven individuals, four were examined and only the center case showed evidence of tuberculous infection.

Patrick C., Lyndale Avenue North. February 4, 1911.

This man, 38 years, was reported as having been sick with pulmonary tuberculosis for the last three years, but not ill enough to be disabled for any length of time. He appears strong and well-nourished, has a well-shaped chest, shows no abnormal signs on examination of chest, complains of pain in his side; his sputum has been reported as showing tubercle bacilli recently, though none were found at this time. His pulse was 65, temperature 98, and the Von Pirquet test showed a positive reaction.

Margaret C., his wife, 36 years, large, robust appearing woman, with a flat chest and poor expansion. There is distant breathing in the middle lobe of the right lung. Temperature 99.4, Von Pirquet test positive. She says that two years ago she was very sick, was greatly reduced in weight and showed many tubercle bacilli in the sputum. She has been in the tuberculosis camp for two summers and is now in very good condition.

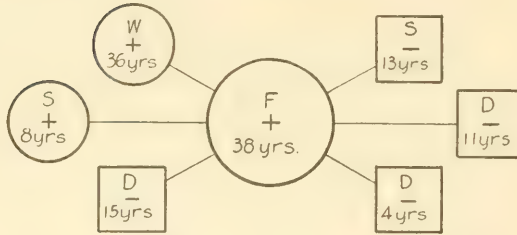
Jennie C., daughter, 15 years, large, well-developed girl; left chest rather retracted at the apex; pulse 90, temperature 99, Von Pirquet test negative.

Nicholas C., son, 13 years, large, strong appearing boy, with slight cervical glandular enlargement; negative to physical examination and negative to the Von Pirquet test.

Laura C., daughter, 11 years, an exceptionally well-developed and healthy looking girl. Nothing abnormal in her physical condition could be found, and she is negative to the Von Pirquet test.

John C., son, 8 years, small, poorly developed, and poorly nourished boy with some cervical glandular enlargement; Von Pirquet test positive.

Mary C., daughter, 4 years, well-developed girl, with few enlarged cervical glands; negative to examination; Von Pirquet test negative.



In this family of five children with both father and mother reported as having had tubercle bacilli in their sputum, only one child shows evidence of tuberculous infection.

The following two cases are classed as healed cases as they presented signs of old tuberculous pulmonary lesions and did not react to the subcutaneous test.

Caroline E., Cedar Avenue. November 5, 1911.

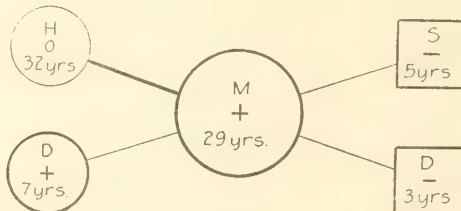
This woman, 29 years, well-nourished, well-developed, was definitely exposed to tuberculosis for a period of four years up to thirteen years ago, her father dying of the disease. Five years ago she was diagnosed tuberculous. She presents signs of an old tuberculous lesion in a small area in the right lung. Temperature 99, positive reaction to Von Pirquet test, and negative to the subcutaneous test.

The father was not examined.

Esther E., daughter, 7 years, poorly nourished, with slight cervical glandular enlargement; pulse 90, temperature 99, negative to physical examination, and gives a positive reaction to the Von Pirquet test.

Roy E., son, 5 years, well-developed, well-nourished boy, is negative to examination and negative to the Von Pirquet test.

Mabel E., daughter, 3 years, very well-nourished, well-built child, shows slight cervical glandular enlargement; pulse 96, temperature 99.3, Von Pirquet test negative.



In this family of five only two show evidence of tuberculous infection. From the mother's history it would seem that she had tubercle bacilli in her sputum five years ago and at that time infected her daughter Esther, the only one now in the family showing evidence of tuberculous infection.

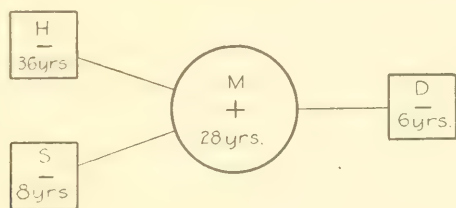
Josie N., 42d Avenue South. March 21, 1911.

This woman, 28 years old, strong and well-nourished, shows plain signs of healed pulmonary lesion, still coughs a little and gives a history of hemorrhages six months and one year ago. Can get no record of tubercle bacilli having been found in her sputum. She gave a positive reaction to the Von Pirquet test and was negative to the subcutaneous test.

Vincent N., husband, 36 years, strong, well-built, well-nourished man, negative to physical examination, negative to the Von Pirquet test.

Frank N., son, 8 years, large, well-nourished boy, negative to physical examination and negative to the Von Pirquet test.

Rose N., daughter, 6 years, large, well-nourished girl, with slight cervical glandular enlargement, negative to physical examination and negative to the Von Pirquet test.



There is no evidence of tuberculous infection in any of the four members of this family other than the center case.

### NON-TUBERCULOUS GROUPS

The following ten families were found to be non-tuberculous and are so classed. They are used as controls.

Alfred F., 11th Avenue South. December 26, 1911.

Is a large, strong looking man, 32 years, is negative to physical examination, and negative to the Von Pirquet test.

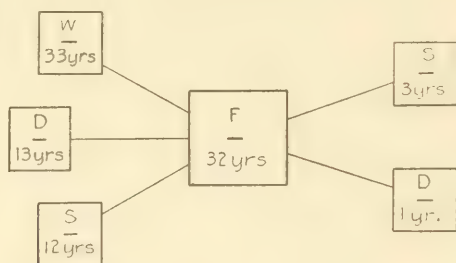
Bertha F., wife, 33 years, is a large, well-nourished woman, negative to physical examination, and negative to the Von Pirquet test.

Lillian F., daughter, 13 years, extra well-developed, well-nourished girl, negative to physical examination, and negative to the Von Pirquet test.

John F., son, 12 years, extra well-developed and well-nourished; shows slight cervical glandular enlargement; negative to physical examination, and negative to the Von Pirquet test.

Earl F., son, 3 years, strong, healthy looking child, well-developed, with slight cervical glandular enlargement, negative to physical examination, negative to the Von Pirquet test.

Dorothy F., daughter, 1 year, strong, healthy well-nourished baby, negative to physical examination, negative to the Von Pirquet test.



This family was reported by the visiting nurses for diagnosis. They had been reported to the visiting nurses as tuberculous or suspicious. Their house conditions were comfortable and fairly hygienic. Diet nourishing. There was no trace of tuberculous infection in the family.

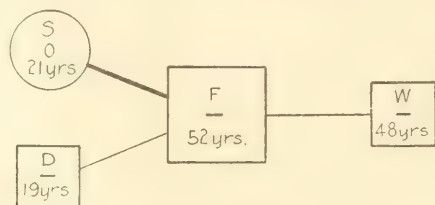
Herman B., 2d Street East. February 2, 1911.

This man, 52 years, well-built, well-nourished, with a barrel-shaped chest, has chronic cough and raises much sputum; can find no evidence of lung involvement though he has chronic bronchitis. No tubercle bacilli could be found in his sputum. Pulse 54, temperature 97; no specific test was made. He had pneumonia two years ago and has coughed ever since. He is a hard drinker and works but little. He says he has been a dispensary patient for a long time, but there is no record of tubercle bacilli having been found in his sputum there.

Emma B., wife, 48 years, large, strong, well-nourished woman, with well-formed chest; negative to physical examination; pulse 84, temperature 97.8; Von Pirquet test not made.

Marie B., daughter, 19 years, slender, anemic, fairly well-nourished, with well-formed chest, but poor expansion, complains of pain in the region of the heart; negative physical examination; pulse 72, temperature 98.6; Von Pirquet test not made.

One son was not examined. The family live in four basement rooms, dark and unventilated but clean. Diet nourishing.



In this family of four individuals, three of whom were examined, no evidence of tuberculous infection could be found.



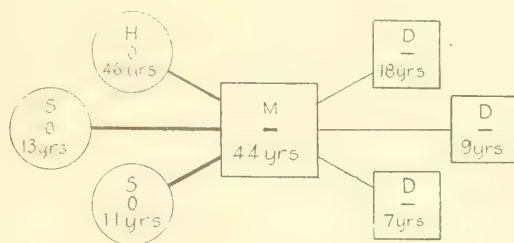
Barbara F., 14th Avenue South. August 3, 1911.

This woman, 44 years of age, small but well-nourished, is negative to examination, and negative to the Von Pirquet test.

Mamie F., daughter, 18 years, well-nourished, well-developed girl, negative to examination, and negative to the Von Pirquet test.

Delia F., daughter, 9 years, tall slender girl, with long narrow chest; is negative to physical examination and negative to the Von Pirquet test.

Julia F., daughter, 7 years, well-developed, well-nourished child, shows slight cervical glandular enlargement; negative to examination, negative to the Von Pirquet test.



In this family of seven, four were examined. None of those examined showed evidence of tuberculous infection. The father and two sons could not be examined. The mother was the reported case. She was a new Health Department case who had not been examined and was referred to me as a suspicious case.

David G., Queen Avenue North. February 24, 1912.

This man, tall, well-developed, 52 years, has short broad chest and presents a few obscure signs on physical examination. Von Pirquet test negative and subcutaneous tuberculin test negative.

Anna G., wife, 44 years, a strong, well-nourished woman, well-developed; negative to physical examination, gives a positive reaction to the Von Pirquet test and a positive reaction to the subcutaneous tuberculin test.

Rosarie G., son, 18 years, strong, well-developed, well-nourished boy; shows very slight cervical glandular enlargement; negative to physical examination and negative to the Von Pirquet test.

Pearl G., daughter, 16 years, well-developed, well-nourished girl; negative to physical examination, and negative to the Von Pirquet test.

Mary Ann G., daughter, 6 years, small, fairly well-nourished, with slight cervical glandular enlargement; negative to physical examination and negative to the Von Pirquet test.

Alexander G., son, 4 years, poorly developed, poorly nourished child,

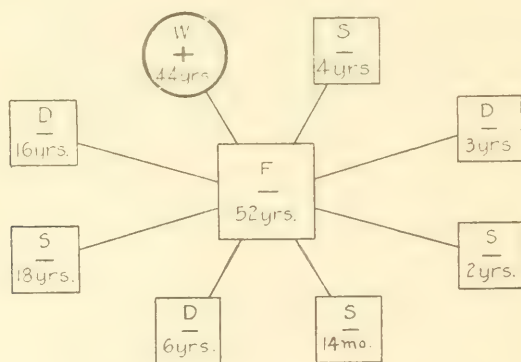
with slight cervical glandular enlargement; negative to physical examination; temperature 99; is negative to the Von Pirquet test.

Jenette G., daughter, 3 years, well-developed, well-nourished child; shows slight cervical glandular enlargement; temperature 99.4; negative to physical examination and negative to the Von Pirquet test.

Frederick G., son, 2 years, well-developed, well-nourished child; shows slight cervical glandular enlargement; negative to physical examination, negative to the Von Pirquet test.

William G., son, 14 months, well-developed, well-nourished baby, with slight cervical glandular enlargement; negative to examination and negative to the Von Pirquet test.

This family is remarkable in some respects. The father was diagnosed as tuberculous six years ago, according to his report, and has been under the observation of the visiting nurses for much of the time since then. He says he has had hemorrhages and tubercle bacilli in his sputum, but has never lost much weight and has worked some every year. No evidence of present or past tuberculous infection can be found in him. His wife, who has no history of tuberculosis as far as could be found and presents no physical signs of the disease, shows a marked reaction to the specific tests.



In this family of nine individuals only one shows evidence of tuberculous infection and that one an unsuspected individual.

Olive H., 20th Avenue North. June 6, 1911.

This woman, 36 years, strong and well-nourished, was reported to the visiting nurses as tuberculous three years ago and although she has been recently pronounced non-tuberculous, the family was examined by request. She is negative physically and negative to the Von Pirquet test.

Hazel H., daughter, 15 years, well-developed, well-nourished girl; negative to physical examination and negative to the Von Pirquet test.

Olive H., daughter, 13 years, well-developed, well-nourished girl; **negative physically and negative to the Von Pirquet test.**

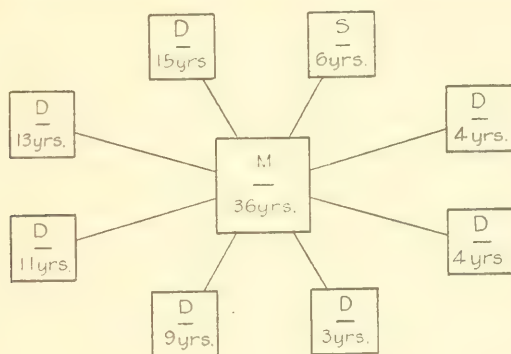
Pearl H., daughter, 11 years, well-developed, well-nourished girl; **negative physically and negative to the Von Pirquet test.**

Gladys H., daughter, 9 years, well-developed, fairly well-nourished girl; has several cervical enlarged glands, negative to physical examination, **negative to the Von Pirquet test.**

Clarence H., son, 6 years, good-sized, well-developed, well-nourished boy, **negative physically, and negative to the Von Pirquet test.**

Stella and Della, daughters, 4 years, well-developed, well-nourished twin girls; both negative to physical examination and negative to the Von Pirquet test.

Dorothea H., daughter, 3 years, well-developed, well-nourished child; negative to physical examination, negative to the Von Pirquet test.



This family of nine individuals which has been supervised as a tuberculous family for a long time shows no evidence of tuberculous infection in any member.

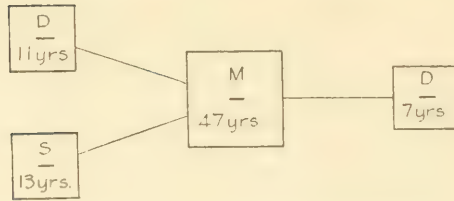
Ida M., Riverside Avenue. December 30, 1911.

This woman, 47 years old, is well-developed, poorly nourished, with a well-shaped chest; negative to physical examination, negative to the Von Pirquet test.

Theodore M., son, 13 years, well-developed, fairly well-nourished, anemic; negative on physical examination and negative to the Von Pirquet test.

Marie M., daughter, 11 years, well-developed, well-nourished girl; **negative physically, negative to the Von Pirquet test.**

Lillian M., daughter, 7 years, well-developed, well-nourished girl; **negative physically and negative to the Von Pirquet test.**



This family has been under supervision for some time. There is no evidence of tuberculous infection to be found in any member.

William M., Thomas Avenue North. March 6, 1912.

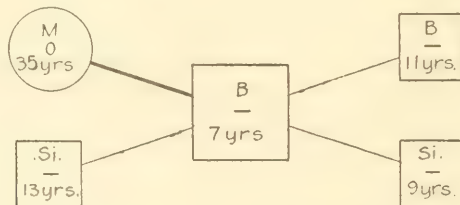
This boy with his brother and two sisters was given as a suspicious case by the Health Department. William M. is 7 years, well-developed, extra well-nourished, with well-shaped chest; negative to physical examination and negative to the Von Pirquet test.

The mother was not examined.

Sadie M., sister, 13 years, tall, well-developed, well-nourished girl, showing some cervical glandular enlargement; physical examination negative; pulse 104; Von Pirquet test negative.

George M., brother, 11 years, well-developed, fairly well-nourished boy; shows long chest, with few rales in right lung; has coughed for five or six years; Von Pirquet test negative.

Addie M., sister, 9 years, short, heavy, very well-developed girl; shows slight cervical glandular enlargement; negative on physical examination and negative to the Von Pirquet test.



In this family of four children no evidence of tuberculous infection was present.

Pearl R., 2d Street North. January 25, 1911.

This girl, 18 years, was reported to the visiting nurses as a case of pulmonary tuberculosis two years ago. She has been in the tuberculosis camp two summers and under tuberculosis precautions for two years. She coughs very little, presents no signs on physical examination, and is negative to the Von Pirquet test. Father and mother not examined.



Arthur R., brother, 16 years, small, underdeveloped boy, poorly nourished, with broad flat chest, and considerable cervical glandular enlargement; left lung expands poorly; pulse 104, temperature 98; Von Pirquet test negative.

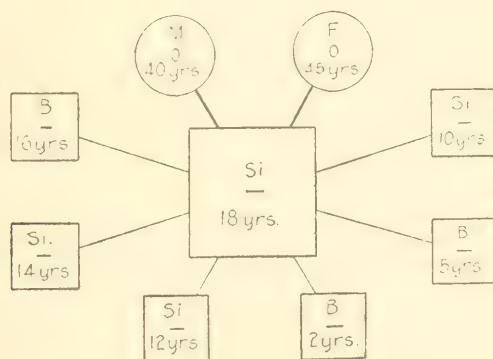
Mabel R., sister, 14 years, large, well-nourished girl; has long deep chest, constricted at the base, and slight cervical glandular enlargement; negative to physical examination, has poor expansion; pulse 85, temperature 99; Von Pirquet test negative.

Lillian R., sister, 12 years, tall, poorly nourished girl, with long narrow chest, slight cervical glandular enlargement; negative to physical examination; pulse 66, temperature 97.2; negative to the Von Pirquet test.

Maude R., sister, 10 years, well-developed, fairly well-nourished girl, with well-shaped chest; negative to physical examination; suffering from *la grippe*; pulse 110, temperature 100.8; Von Pirquet test negative.

Roy R., brother, 5 years, well-grown, well-nourished boy, showing some cervical glandular enlargement; temperature 99; negative on physical examination and negative to the Von Pirquet test.

Robert R., brother, 2 years, normally developed baby, with slight cervical glandular enlargement; negative on physical examination and negative to the Von Pirquet test.



The house conditions here are bad. Small, dark, dirty rooms. Pearl has a room to herself, but eight others sleep in two rooms. Can find no evidence of tuberculous infection in this family.

Mrs. Anna V., 21st Avenue South. February 27, 1911.

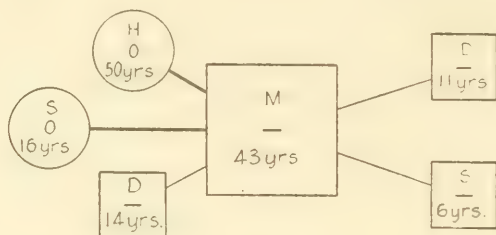
This woman, 43 years, poorly nourished, with a barrel-shaped chest, has had asthma for years. No tubercle bacilli have ever been found in her sputum. She was examined by the writer a year ago and she is now in the same condition as at that time. She shows no evidence of tuberculosis. Is negative to the Von Pirquet test.

The father and one son were not examined.

Gladys V., daughter, 14 years, very large, well-developed girl, well-nourished, negative to physical examination, negative to the Von Pirquet test.

Mary V., daughter, 11 years, very large, well-nourished girl, negative physically, and negative to the Von Pirquet test.

Edward V., son, 6 years, large, well-nourished boy, negative to physical examination, negative to the Von Pirquet test.



In this family of six individuals, four were examined and none of them showed evidence of tuberculous infection.

Benjamin W., Lyndale Place. May 21, 1911.

This man, 45 years, is well-built and well-nourished, has chronic bronchitis, and gives a history of asthma; pulse 68, temperature 98.6; Von Pirquet test negative, subcutaneous test negative two years ago.

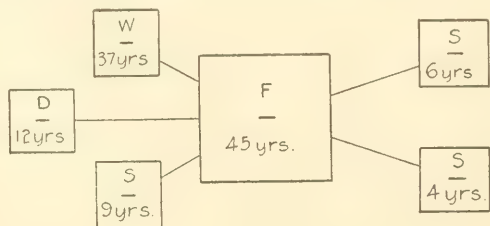
Fanny W., wife, 37 years, well-developed, fairly well-nourished, negative physically, negative to the Von Pirquet test.

Jennie W., daughter, 12 years, slight, underdeveloped girl, fairly well-nourished, with poorly shaped chest, anemic; physical examination shows a heart lesion; pulse 84, temperature 100; Von Pirquet test negative.

Allie W., son, 9 years, slight, underdeveloped, poorly nourished boy, with poorly shaped chest; has chronic bronchitis; pulse 98, temperature 99.8; Von Pirquet test negative.

Aaron W., son, 6 years, short, heavy boy, with well-formed chest; negative to physical examination, negative to Von Pirquet test.

Isadore W., son, 4 years, short, heavy child; has well-shaped chest; negative physically and negative to the Von Pirquet test.



Of this family three members, the father, age 45, Allie, age 9, and Jennie, age 12, have been reported to the visiting nurses as tuberculous. The only one presenting suspicious signs is Allie. In the absence of a positive Von Pirquet he is classed negative. The house is light, roomy but ill-ventilated. Diet insufficient. They have been supervised as tuberculous cases for two or three years.

The following five families were selected as non-tuberculous families and are used as controls, together with the preceding ten families, who proved on examination to be non-tuberculous:

Nicholas C., 19th Avenue Southeast. May 27, 1912.

The father of this family could not be examined.

Mrs. Anna C., 30 years, robust, well-developed woman, negative to physical examination, gives a positive reaction to the Von Pirquet test.

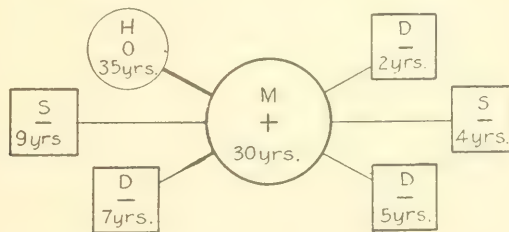
Henry C., son, 9 years, well-developed, well-nourished boy, negative to examination, negative to the Von Pirquet test.

Lucile C., daughter, 7 years, well-developed, well-nourished child, negative to physical examination, negative to the Von Pirquet test.

Esther C., daughter, 5 years, slight, underdeveloped, poorly nourished child, negative to examination, and negative to the Von Pirquet test.

Ralph C., son, 4 years, slender, poorly nourished child, negative to physical examination, negative to the Von Pirquet test.

Isabel C., daughter, 2 years, well-developed, well-nourished child, negative to physical examination, negative to the Von Pirquet test.



In this family of seven individuals who have never been exposed to tuberculosis there is evidence of tuberculous infection in one individual.

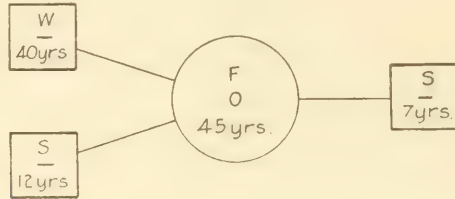
T. G. C., 19th Avenue Southeast. May 27, 1912.

This man was not examined.

P. C., wife, 40 years, who is stepmother to these boys, is a slight, poorly nourished woman, who is negative to physical examination and negative to the Von Pirquet test.

Edmund C., son, 12 years, well-developed, well-nourished boy, negative to physical examination, negative to the Von Pirquet test.

Morris C., son, 7 years, a slight, underdeveloped boy, negative to physical examination, and negative to the Von Pirquet test.



In this family of four individuals, three were examined and none showed evidence of tuberculous infection.

David D., 21st Avenue Southeast. May 27, 1912.

This man, father of this family, was not examined.

Lilian D., wife, 34 years, strong, well-nourished woman, negative to physical examination and negative to Von Pirquet test.

Ethel D., daughter, 14 years, well-developed, well-nourished girl, negative to physical examination and negative to the Von Pirquet test.

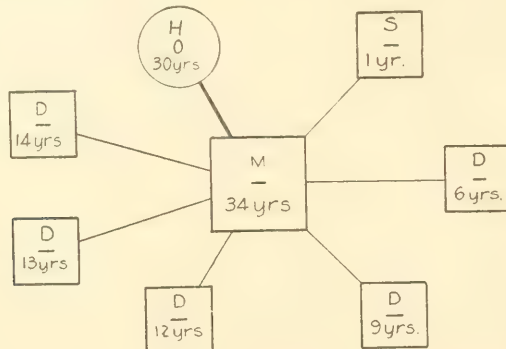
Ida D., daughter, 13 years, well-developed, well-nourished girl, negative to physical examination, and negative to the Von Pirquet test.

Gladys D., daughter, 12 years, well-developed, well-nourished girl, negative to physical examination and negative to the Von Pirquet test.

Ruth D., daughter, 9 years, well-developed, heavy girl, negative to physical examination and negative to the Von Pirquet test.

Artys D., daughter, 6 years, short, heavy girl, negative to physical examination and negative to the Von Pirquet test.

Arthur D., son, 1 year, heavy, well-developed baby, negative to physical examination and negative to the Von Pirquet test.





In this family of eight individuals, seven were examined and none showed evidence of tuberculous infection.

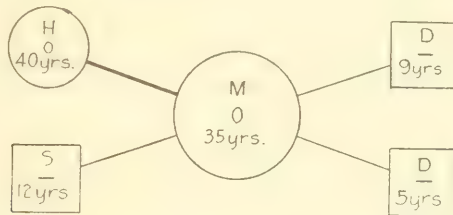
S. M. W. May 14, 1912.

This man and his wife were not examined as they are reliably reported non-tuberculous.

A. W., son, 12 years, is a large, very well-developed, well-nourished boy, negative to physical examination, and negative to the Von Pirquet test.

E. W., daughter, 9 years, tall, well-developed girl, negative to physical examination, and negative to the Von Pirquet test.

M. W., daughter, 5 years, well-developed, well-nourished girl, negative to physical examination, and negative to the Von Pirquet test.



In this family of five individuals, three were examined and none showed evidence of tuberculous infection.

H. G. L. July 10, 1912.

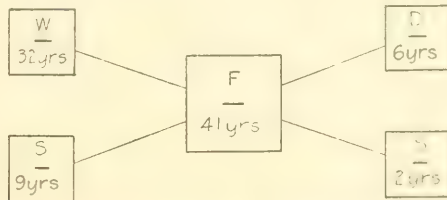
This man, 41 years, is negative to physical examination and negative to the Von Pirquet test.

Edith L., wife, 32 years, negative to examination and negative to the Von Pirquet test.

Laird L., son, 9 years, large, well-developed boy, negative to the Von Pirquet test, and negative to physical examination.

Elizabeth L., daughter, 6 years, tall, poorly nourished child, negative to physical examination, and negative to the Von Pirquet test.

Robert L., son, 2 years, small, poorly developed baby, negative to physical examination, and negative to the Von Pirquet test.



In this family of five individuals, all were examined and none showed evidence of tuberculous infection.

In thirty-three families classed as containing open cases of pulmonary tuberculosis, 173 individuals were examined. Of those examined, 124 individuals showed evidence of tuberculous infection, 41 showed no evidence of tuberculous infection, and 8 individuals were doubtful or suspicious. These suspicious cases were those which showed more or less signs of tuberculous infection but gave a negative Von Pirquet test; or not showing physical signs, gave an atypical reaction to the tests employed. All those classed as infected with tuberculosis gave a typical reaction to the tuberculin tests. Of the eight suspicious cases, one has since been declared tuberculous at the University Dispensary and one has had a pulmonary hemorrhage; both were adults and neither is included in the list of tuberculous infections.

Among the 124 showing evidence of tuberculous infection are the 23 living center cases. Deducting the 23 center cases, we have 101 individuals presumably infected from 33 open center cases, or 3 and  $\frac{2}{33}$  for each case. Excluding the center cases, 67 per cent of the individuals exposed showed evidence of infection with the tubercle bacillus.

In four families classed as containing latent center cases, 22 individuals were examined. Of those examined 8 showed evidence of tuberculous infection and three were suspicious. Deducting the four center cases, we have a spread of infection in 22 per cent of individuals exposed.

In three families classed as containing healed center cases, 12 individuals were examined. Of the 12 examined, 6 showed evidence of tuberculous infection. Deducting the three center cases, we have a spread of infection in 33 per cent of the individuals exposed.

In ten families classed as containing non-tuberculous center cases, 56 individuals were examined. Of the 56 examined, one individual showed evidence of tuberculous infection and two were suspicious, an infection of 1.7 per cent of all individuals in the household.

In five families classed as controls and containing no reported or suspected cases of tuberculosis, 24 individuals were examined. Of those examined, one showed evidence of tuberculous infection, 4.1 per cent of all individuals in the household.

Dividing all families examined into two classes, tuberculous and non-tuberculous, there were forty tuberculous families and fifteen non-tuberculous families. In the forty tuberculous families 207 individuals were examined, of whom 138 individuals showed evidence of tuberculous infection. In the fifteen non-tuberculous families 80 individuals were examined, of whom two showed evidence of tuberculous infection and two were suspicious. That is, 66 $\frac{2}{3}$  per cent of individuals examined in tuberculous families showed evidence of tuberculous infection, and 2 $\frac{1}{2}$  per cent of the individuals examined in non-tuberculous families showed evidence of infection with tuberculosis.

Among the forty tuberculous families there are ten families containing

54 individuals, of whom every member was examined, and in which every member showed evidence of tuberculous infection.

Three families containing 12 members, of whom 7 were examined, showed evidence of tuberculous infection in all those examined.

In the latent group there was one family of seven individuals, of whom four were examined in whom no evidence of tuberculous infection could be found outside of the center case. Another latent case in a family of four showed only one individual infected, namely, the wife, and this probably a coincident infection as she had been otherwise exposed. No tubercle bacilli had ever been found in the sputum of this center case. In another latent case there were five children and the wife besides the center case, and only one child showed evidence of infection.

In another latent case where both husband and wife had been reported open cases there was but one child out of five who showed evidence of infection. One of the healed cases showed no spread of infection in a family of four. Another, where the mother is a healed case, shows two out of four children with evidence of tuberculous infection. In this case the history would indicate that the lesion had healed before the birth of the two immune children. In another case where the mother was diagnosed as an open case, her health greatly improved before the birth of her second child, the oldest child shows evidence of tuberculous infection and the two succeeding children do not.

The analysis of the non-tuberculous cases is simple. The one case of tuberculous infection found in the ten non-tuberculous families, which had been reported to the visiting nurses as tuberculous or suspected families, was the wife of a man who had been reported tuberculous and had been supervised for a number of years. He had at one time lost weight and at different times had hemorrhages, but no record of tubercle bacilli having been present in his sputum could be found. He showed no signs of a tuberculous lesion, and did not react to the tuberculin tests. The wife had not been a suspected case and showed no signs on physical examination, but reacted to the tuberculin tests. The family of seven children, five of them under six years of age, were without any indication of tuberculous infection. One other case with evidence of tuberculous infection occurred in one of my control families where no tuberculosis was suspected. The woman who showed evidence of tuberculous infection gives a history of having been in delicate health for two years during childhood. She has five healthy non-tuberculous children.

The following is a statement showing the percentages of tuberculous infections in thirty tuberculous families in which there were open cases, contrasting those supervised by visiting nurses with those not so supervised;

also between the cases not supervised and those supervised for different lengths of time. The time of supervision was obtained from the records of the visiting nurses of the Associated Charities, Minneapolis, Minn.

In eleven families supervised for less than one month, including all those not supervised at all, 55 people were examined. Of these, 43, or 78.2 per cent, showed evidence of tuberculous infection.

In nineteen families supervised for more than one month, 100 individuals were examined. Of these, 74, or 74 per cent, showed evidence of tuberculous infection. Average time of supervision,  $12\frac{1}{2}$  months.

In thirteen families supervised for more than six months, 74 individuals were examined. Of these, 54, or 73 per cent, showed evidence of tuberculous infection. Average time of supervision,  $16\frac{1}{2}$  months.

In six families supervised for more than one year, 24 individuals were examined. Of these, 16, or  $66\frac{2}{3}$  per cent, showed evidence of tuberculous infection. Average time of supervision,  $26\frac{1}{2}$  months.

In four families supervised for over two years, 17 people were examined. Of these, 12, or  $70\frac{2}{3}$  per cent, showed evidence of tuberculous infection. Average time of supervision,  $32\frac{1}{2}$  months.

I conclude from the above studies, first, that the spread of tuberculous infection in families where open cases of tuberculosis exist is greater than it is generally understood to be. Sixty-seven per cent of the individuals of these families, excluding the center cases, show evidence of tuberculous infection. In no case where there has been definite proven exposure of a family to an open case of tuberculosis, no matter what precautions have been taken, have I failed to find a spread of infection. In at least ten cases investigated, the infection has spread to the limit of available material. Every member of these ten families shows evidence of tuberculous infection.

Second, that in families where no cases of tuberculosis have been found, no matter what the home life or living conditions were, the number of individuals showing evidence of tuberculous infection was small, namely  $2\frac{1}{2}$  per cent.

Third, that in families where cases of latent tuberculosis exist, the spread of infection is not as great as in families where open cases of tuberculosis are found, 22 per cent against 67 per cent.

Fourth, that in families where healed cases of tuberculosis are present, the spread of infection is less than in families where open cases exist, 33 per cent against 67 per cent.

Fifth, that in families where no tuberculosis is found, the number of individuals showing evidence of infection is very small ( $2\frac{1}{2}$  per cent) in comparison with the families in which open, latent, or healed tuberculosis exists.









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